Joint Precision Airdrop System [JPADS] with Diamond Systems Europe components on Board

By Stephen Baginski

Joint Precision Airdrop System [JPADS] combines the Army's Precision and Extended Glide Airdrop System (PEGASYS) program with the Air Force's Precision Airdrop System (PADS) program to meet joint requirements for precision airdrop. PEGASYS is the name of a family of precision airdrop systems, consisting of extra light, light, medium and heavy payload categories. It consists of a canopy decelerator and airborne guidance unit, including a Global Positioning System, along with the appropriate pallet platform. PADS is an on-board computer system predicting release points for ballistic or "dumb" parachute systems for high altitude airdrops. It uses mission-planning and weather forecasting software, and can receive en-route mission changes and weather updates via satellite links.

This is the first time that a program of this complexity was undertaken to turn "dumb" airdrop systems into "smart" ones. The Joint Precision Airdrop System (JPADS) provides a Joint and Service Airdrop Capability as a means of providing distributive sustainment, supply and re-supply to ground component forces. Range and speed of the air carrier allows airdrop to pass through the global time and distance paradigm, and exercise "reach" across all levels of war.

JPADS is a high altitude capable guided precision airdrop system that provides increased control release from the aircraft, and reduces load dispersion on the ground. JPADS is controlled by the assistance of a mission planner laptop with precision airdrop applications, meteorology data gathering kit, and GPS re-Broadcast kit. JPADS satisfies four identified principal needs/"gaps" in the joint airdrop functional area; increased ground accuracy, standoff delivery, increased air carrier survivability, and improved effectiveness/assessment feedback regarding airdrop mission operations.

The decelerator is the technical term for a parachute or parafoil (both being in wide use). JPADS will use either a parafoil or a parafoil/parachute hybrid for flight of the load through descent and deceleration. The decelerator provides JPADS with directional capability in

flight. Decelerator steering lines run to the Airborne Guidance Unit (AGU) and are used to create drag on one side of the decelerator or the other, providing for directional control.

The Airborne Guidance Unit (AGU) houses the battery power pack; GPS receiver; guidance, navigation and control (GN&C) software package; and the hardware required to operate the steering lines(s). The AGU, using initialized data from JPADS component, GPS re-transmission system, acquires its position prior to exit from the aircraft. Once the position is acquired, the AGU steers in accordance with the planned trajectory, making corrections in flight as necessary via an actuator system attached to the steering line(s).

The Mission Planner enables aircrews to plan and initiate load release at a precise Computed Air Release Point (CARP), or within a Launch Acceptance Region (LAR), through application of accurate, JPAD component modelling. The MP provides the capability to model parameters of aircraft position, altitude, airspeed, heading, ground speed, course, onboard load position (station), roll-out/exit time, decelerator opening time, trajectory to stabilization and descent rate. Descent trajectory to the desired point(s) of impact is enhanced via atmospheric, three-dimensional wind and density information to be encountered. MP capability enables programming and targeting of the AGU to include: drop and target altitudes, steering waypoints, wind magnitude/directions as a function of altitude, opening altitudes, and GPS "hot start" information. Mission planning is done pre-flight and on-board the aircraft making use of the aircraft's power, antennae, 1553 data bus when available, and secure data communications (when installed). Basic hardware components include a portable, rugged, high pressure tolerant laptop computer, drop-sondes, and an interface processor that is man-portable and installed aboard selected delivery aircraft in roll-on, roll-off configuration.

The largest error component in high-altitude parachute cargo delivery release point calculation is the wind estimate. The PADS system provides real-time onboard updates of the release point by utilising:

* Atmospheric models (high-resolution 4-D forecast fields from a supporting met office)
* Atmospheric measurement equipment (wind data from hand-deployed drop-sondes)
* Onboard full physics and dynamics data assimilation with high-resolution topography and the 4-D forecast fields
* Planned point-of-impact, load/canopy data, and aircraft heading, airspeed and altitude
* 3-D weather field for load roll-out / canopy-opening / fall-trajectory model

As the aircraft enters the target area, it releases a probe that transmits real-time wind data back to the aircraft, the laptop on the plane takes that wind data a computes a 'launch acceptable' region. The crew then flies and releases the bundle within that region.

After being released from altitudes as high as 8,000 m, the pallet drops at speeds topping 170 km an hour to a secondary release point 300 to 500 m above the ground. From that point, the JPAD system releases a larger canopy that delivers the load safely to the ground.

Part of Diamond Systems Europe and Acal Technology Netherlands activities in supporting exceptional military (and more recently rescue operations in civil areas) resulted in applications suitable for PC/104 technology in which we excel. Thus above application contains items described below.

Emerald-MM-8P offers 8 multi-protocol serial ports on a single PC/104 module with complete software configurability. Each port can be individually selected for RS-232, RS-422, or RS-485 under software control. Both local-echo and non-local-echo modes are supported for RS-485. I/O addresses and interrupt levels are also programmable, with interrupt sharing available for any number of ports. Each port may further be enabled or disabled in software. All configuration data is stored in an on-board EEPROM that is loaded automatically on power-up.

For applications where fixed addresses are desired, four groups of preset addresses are available with jumper settings that override the programmed settings. Line termination for RS-422/485 modes is also jumper-selectable. Emerald-MM-8P offers 8 convenient digital I/O lines. The direction of each line is independently programmable.

Two I/O headers are provided, with four serial ports and four digital I/O lines on each header. The board operates on +5V only, eliminating the need for a +12V supply that is often required for serial port operation.

Emerald-MM-8P is based on the 16C654 quad serial port IC. This device contains 4 identical sets of registers, one for each port, and is compatible with the standard PC serial port. Each port contains 64-byte transmit and receive FIFOs to support the high-speed 460.8kbps data rates. Model EMM-8P-XT is backward compatible with Diamond Systems' EMM-8M-XT and EMM-8232-XT boards.

Diamond Systems Europe GmbH Programmable Serial Ports unit in use at JPADS controls

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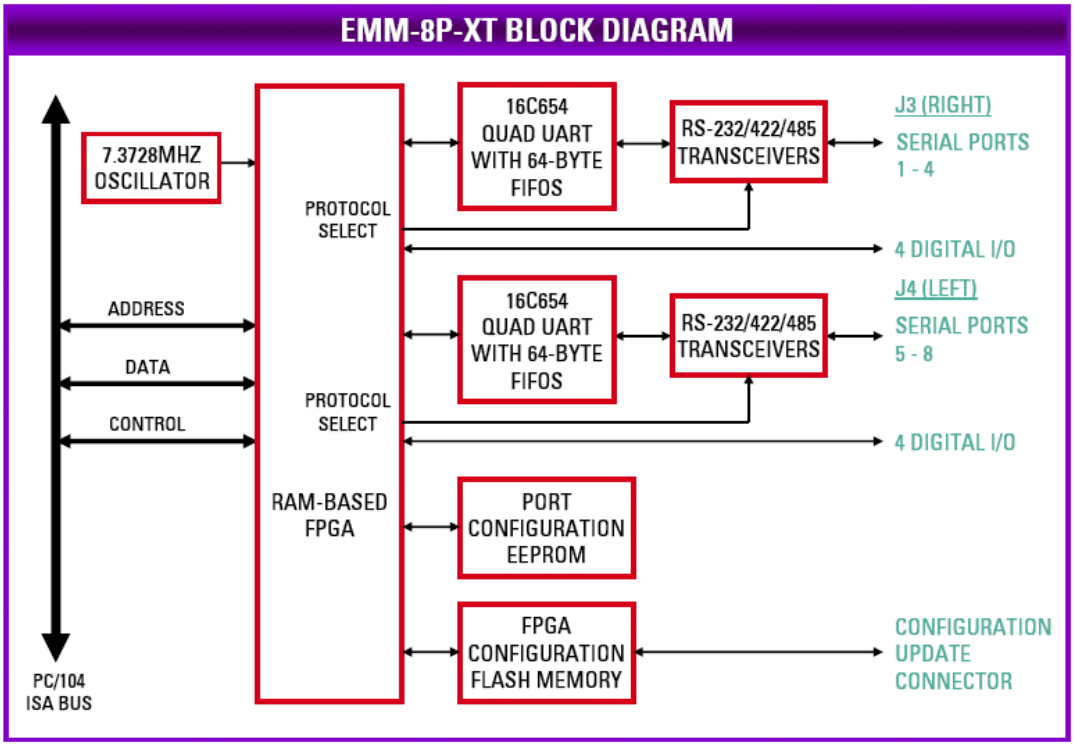

The features of the unit:

Number of serial ports:	8
Protocols:	RS-232, RS-422, RS-485 (local and no echo)
Configuration:	All features software configurable
Maximum baud rate:	460.8kbps
Communications par.:	5, 6, 7, or 8 data bits; Even, odd, or no parity
Short circuit protection:	Continuous, all outputs

RS-232 mode

Input Impedance	3KΩ min
Input voltage swing	±30V maximum
Output voltage swing	±5V min, ±7V typical

RS-422/RS-485 modes:

Differential input threshold	-0.2V min, +0.2V max
Input impedance	12KΩ minimum
Input current:	+1.0mA max (Vin = 12V) -0.8mA max (Vin = -7V)
Differential output voltage	2.0V min (RL=50Ω)
High/low states differentia	
output voltage symmetry	0.2V max
Digital I/O Number of I/O lines	8 in, 8 out
Input voltage Low:	-0.3V min, 0.8V max
Output voltage Low:	0.0V min, 0.4V max (IOL = 6mA max)

General

I/O header 2 40-position (2x10) .025" square pin header on .1" centers; Headers mate with standard ribbon cable (IDC) connectors

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Dimensions	3.55" x 3.775"
Power supply	+5VDC ±10%
Current consumption	160mA typical, all outputs unloaded
Operating temperature	-40 to +85°C standard, all versions

In addition to the above unit, a suitable PC/104 Housing Kit and a Memory board were also successfully integrated into the above mentioned AGU. For detailed product description please click at the link below.

About ACAL Technologies Nederland bv: ACAL Technologies is a leading distributor of Component, ICT products and Services in the Netherlands. For more info click: http://www.acaltechnology.nl Phone no: +31 (0)40 2 502 602

About Diamond Systems Europe GmbH: DSE is an international leaders supplying state of the art technology to various and demanding End Users. DSE is located in Zurich, Switzerland. For more information click: http://www.diamondsystems.ch
Phone no: +41 44 850 7002, and worldwide: +1 (650) 810-2500

About the Author:

Stephen F. Baginski is an entrepreneur, publisher, blogger and journalist. He was for years the European Bureau Chief at Open Systems Publishing (www.opensystems-publishing.com), one of the largest publishing houses for open systems. He is consulting on Embedded Technology for customers like Kontron, Siemens, Nokia-Mayfair, Diamond Systems and others. He is based in Switzerland and carries Canadian citizenship.

Prior to OSP, Stephen held positions of responsibility with General Electric at Danforth Facility (classified project), Ontario Research Foundation (nuclear projects), Sniffer Technology (network security, wireless) in Santa Clara, SAAB-Fairchild Electronic (avionics) in Södertälje, Sweden; and Kontron (former PEP) Modular Computers (VME-Autobahn Project, with Motorola) in Kaufbeuren, Germany.

Stephen responsibilities progressed from System Engineer to Managing Director and CEO.

Stephen professional affiliations include (past and present): Society of Manufacturing Engineers, American Management Association, Society of American Engineers, Association of Professional Engineers of the province of Ontario, Royal Engineering Association of Sweden, German Engineers Society (VDI), he was active in VITA Europe. Dr. Baginski is also member of the Association of Swiss Journalists, and the International Federation of Journalists.

He is married, has two children. In his spare time he enjoys yachting, biking, and reading. Stephen is member of the cantonal champion's team in Reiden, shooting small calibre sports pistol.